C0804500.798

GENERAL CONCRETE REQUIREMENTS

NOTES:

Use this paragraph for jobs where the total amount of concrete is about 100 cubic yards or less, where the features of concrete construction are such that detailed control of concrete operations are impracticable, and where very severe sulfates do not exist in the soil or groundwater.

The guide paragraph is set up assuming that reinforcing bars will be required. If reinforcing bars are not required, additional editing will be necessary.

REVISIONS

Reference Standards Version Checked/Updated: 7-6-98

Other Changes:

7-6-98: Added reference paragraph. Revised wording for slump. Moved footnotes to text.

SECTION ____ - GENERAL CONCRETE REQUIREMENTS

_____ GENERAL

The Contractor shall furnish all materials for use in concrete, including cementitious materials, water, sand, coarse aggregate, and specified admixtures; and shall furnish all reinforcing bars [1][and fabric] and materials for curing concrete. Cementitious materials shall mean portland cement only or portland cement plus a pozzolan.

_____ REFERENCES

The publications with approval or revision date listed below form a part of this specification to the extent referenced.

[1] Delete if fabric not required.

UNITED STATES BUREAU OF RECLAMATION (USBR)

Standard	Date	Title
M-30	10-1-80	Specifications for Concrete Curing Compound
M-47	8-1-96	Standard Specifications for Repair of Concrete *
	1981	Concrete Manual - Eighth Edition, Revised Reprint *

* Printed as Water and Power Resources Service publication.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

Standard	Title
[2][ASTM A 185-97	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement]
[3]ASTM A 497-97	Steel Welded Wire, Deformed, for Concrete Reinforcement
ASTM A 615-96a	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 617-96a	Axle-Formed Deformed and Palin Bars for Concrete Reinforcement
ASTM C 33-93	Concrete Aggregates
ASTM C 94-96e1	Ready-Mixed Concrete
ASTM C 114-97	Chemical Analysis of Hydraulic Cement
ASTM C 150-97	Portland Cement
ASTM C 171-97a	Sheet Materials for Curing Concrete
ASTM C 260-95	Air-Entraining Admixtures for Concrete

[2] Delete if plain wire fabric not required.

[3] Delete if deformed wire fabric not required.

Standard	Title
ASTM C 494-92	Chemical Admixtures for Concrete
ASTM C 618-97	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
ASTM C 1017-92	Chemical Admixtures for Use in Producing Flowing Concrete
ASTM D 98-95	Calcium Chloride

_____ SUBMITTALS

Submittals shall be in accordance with this paragraph and paragraphs ____ (Repair of Concrete) and ____ (Submittal Requirements).

a. Approval data. - Thirty days prior to placement of concrete, the Contractor shall submit to the Government the name and manufacturer of each cementitious material, admixture, curing compound, and aggregate source. The Government reserves the right to require submission of manufacturer's test data and certification of compliance with specifications, and to require submission of samples of all concrete materials for testing prior to or during use in concrete.

b. Mix design. - The Contractor shall submit each concrete mix design for approval prior to the use of the concrete mix.

_____ MATERIALS

a. Cement. - Portland cement shall meet the requirements of ASTM C 150 for type [4][_] portland cement [5][except that the maximum percent of tricalcium aluminate allowable in type I cement shall be 15 percent] and shall meet the low-alkali and false-set limitations specified therein. The low-alkali limitation for cement may be waived on request if the sand and coarse aggregate do not contain objectionable quantities, as determined by the Contracting Officer, of potentially alkali-reactive particles defined by mortar bar tests and complete petrographic analyses of the proposed aggregate. If the Contractor requests waiver of the low-alkali limitation, the Contractor shall submit petrographic analyses satisfactory to the Contracting Officer unless such analyses have been performed by the Bureau of Reclamation. Cement shall be free from lumps and contamination by water and other foreign matter when used in concrete.

b. Pozzolan. - Pozzolan shall meet the requirements of ASTM C 618 for class N, F, or C with the following additional requirements:

(1) The maximum percent of sulfur trioxide shall be 4 percent for classes F and C.

(2) The maximum percent loss on ignition shall be 8 percent for class N and 2.5 percent for classes F and C.

(3) Unless the Contractor selects aggregates which are not potentially alkali reactive, pozzolan shall be tested for effectiveness in controlling alkali-silica reaction under the

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[4] Determine type of cement to be used.

[5] Include only when type I cement is specified.

optional physical requirements in table 2A of ASTM C 618. However, cement used shall be low alkali.

(4) Pozzolan shall not decrease the sulfate resistance of concrete. Before a class N pozzolan is used, it shall be shown by test and experience not to detract from sulfate resistance. Before a class F or C pozzolan is used, it will be shown to have an "R" factor less than 2.5. "R" is defined as (C-5)/F where C is the calcium oxide content of the pozzolan in percent, and F is the ferric oxide content in percent, determined in accordance with ASTM C 114.

c. Water. - Water shall conform to ASTM C 94, paragraph 4.1.3.1 (including table 1).

d. Sand and coarse aggregate. - Sand and coarse aggregate shall consist of clean, hard, dense, durable, uncoated rock fragments that are free from injurious amounts of dirt, organic matter, and other deleterious substances. Sand and coarse aggregate shall meet all requirements of ASTM C 33. Coarse aggregate shall conform to ASTM C 33 gradings for either size No. 467 (1-1/2 inches to No. 4 United States Standard sieve) or size No. 57 (1 inch to No. 4).

e. Air-entraining admixture. - Air-entraining admixture shall conform to ASTM C 260. Air-entraining admixtures used with type F or G chemical admixture shall be a neutralized vinsol resin formulation.

f. Chemical admixture. - Chemical admixtures which will introduce more than 1/10 of 1 percent chloride, by weight, of cementitious materials shall not be used in concrete for

prestressed concrete, bridge decks, or concrete in which aluminum, galvanized metalwork, or other dissimilar steel is to be embedded.

(1) [6][In all other concrete, accelerator may be furnished and used during cold weather as hereinafter provided and shall conform to ASTM C 494 for type C or E. In addition, if used as an accelerator, calcium chloride shall meet requirements of ASTM D 98 and shall be no coarser than grade A, class 1, or shall be liquid. The portion of mixing water containing other admixtures shall not come in contact with the calcium chloride before entering the mixer.]

(2) The Contractor may use water-reducing or water-reducing, set-controlling chemical admixtures which conform to ASTM C 494, type A, D, F, or G.

(3) The Contractor may use chemical admixtures for producing flowing concrete which conforms to ASTM C 1017 for type 1 or 2.

g. Reinforcing bars [7][and fabric]. - Reinforcing bars shall be deformed reinforcement bars conforming to ASTM A 615 or A 617, grade [8][40 or 60]. [9][Fabric shall be electrically welded-wire fabric conforming to ASTM A 185 or A 497.]

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[6] Delete if type V cement is being specified, if the concrete is primarily for substation and transmission line foundation, or if the use of set-accelerating admixtures will otherwise be prohibited.

[7] Delete if fabric not required.

[8] Delete of revise as required for grade as appropriate.

[9] Delete if fabric not required.

h. Curing compound. - Wax-base (type I) and water-emulsified, resin-base (type II) curing compound shall conform to the requirements of USBR M-30. Curing compound shall be of uniform consistency and quality within each container and from shipment to shipment.

i. Polyethylene film. - Polyethylene film for curing concrete shall be opaque white, 4 mils thick, and shall conform to ASTM C 171.

_____ COMPOSITION

Unless otherwise directed, the Contractor shall design the concrete mix in accordance with these specifications. Pozzolan, as specified, is an acceptable partial replacement for cement and if used shall replace 20 percent, by weight, of cement. Mix designs shall provide for the minimum cementitious materials contents listed in table ____ (Minimum cementitious materials content).

Table ____. - Minimum cementitious materials content

Nominal maximum size aggregate in concrete, inches	Minimum cementitious materials content without water-reducing admixture, lb/yd^3	Minimum cementitious materials content with water-reducing admixture, lb/yd^3
1-1/2	565	535
1	620	585
[10][3/4	658	625]

Each mix design shall be submitted to the Contracting Officer for review prior to use of the concrete mix. See subparagraph ____ (Submittals).

[10] Include only when 1-inch and larger aggregate is not appropriate, contact D-8180 before using.

The Contracting Officer will test concrete for compliance with specifications and reserves the right to design and adjust the concrete mix proportions.

Air-entraining admixture shall be used in such an amount as will effect the entrainment of from 4 to 6 percent air, by volume, of the concrete as discharged at the placement.

The slump of the concrete shall be from 2 to 4 inches when placed and shall not exceed 5 inches when first mixed, unless a type 1 or 2 plasticizing chemical admixture is used to produce flowing concrete for an unusual placing condition. Then the slump shall be appropriate for the placing conditions.

[11][Chemical admixtures which conform to ASTM C 494 for type C or E, including calcium chloride, shall not be used in concrete.]

____ BATCHING, MIXING, AND TRANSPORTING

Concrete shall be manufactured and delivered in accordance with ASTM C 94.

When bulk cementitious materials and aggregates are dry batched and hauled to where mixing is accomplished, each batch shall be protected during transit to prevent loss and to limit prehydration of cementitious materials. Separate compartments with suitable covers shall be provided to protect the cementitious materials, or they shall be completely enfolded in and covered by the aggregates to prevent wind loss. If cementitious materials are enfolded in moist aggregates or otherwise exposed to moisture and delays occur between batching and mixing, the

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[11] Use this sentence if type V cement is being specified or if use of set-accelerating admixture is otherwise prohibited. If an accelerator is to be used, delete this sentence.

Contractor shall, at the Contractor's expense, add extra cementitious materials to each batch in accordance with the schedule in table ____ (Additional cementitious materials requirements.)

Table ____. - Additional cementitious materials requirements

Hours of contact between cementitious materials and wet aggregate	Additional cementitious materials required, percent
0 to 2	0
2 to 3	5
3 to 4	10
4 to 5	15
5 to 6	20
Over 6	Batch will be rejected

The Government reserves the right to require the addition of cementitious materials for shorter periods of contact during periods of hot weather, and the Contractor shall be entitled to no additional compensation by reason of the shortened period of contact.

When delivered at the jobsite, each batch of concrete shall be accompanied by a batch ticket in accordance with ASTM C 94. The batch ticket shall be delivered to the Contracting Officer's representative at the jobsite as each batch is delivered.

____ CONCRETE PLACEMENT, CURING, AND PROTECTION

Steel reinforcing bars [12][and fabric] shall be placed as shown on the drawings. Before reinforcement is placed, the reinforcement shall be cleaned of heavy, flaky rust; loose mill scale; dirt; grease; or other foreign substances. Reinforcement shall be accurately placed and secured in position so that it will not be displaced during the placing of concrete.

[12] Delete if fabric not required.

Forms shall be used to shape concrete to required lines. Exposed unformed surfaces shall be brought to uniform surface and given a reasonably smooth, wood-float or steel-trowel finish as directed.

The temperature of concrete when it is being placed shall be not more than 90 degrees F and not less than 50 degrees F.

Concrete shall be cured with water, curing compound, or polyethylene sheets. If water cured, concrete shall be kept continuously moist for at least 14 days after being placed by sprinkling or spraying, or by other methods approved by the Contracting Officer. Curing compound, when used, shall be applied in accordance with procedures contained in the USBR "Concrete Manual." Concrete cured by covering with polyethylene sheeting shall be kept continuously moist for at least 14 days after placement.

The Contractor shall protect all concrete against injury until final acceptance by the Government. Concrete shall be maintained at a temperature not lower than 50 degrees F for at least 72 hours after it is placed and, if water cured, shall be protected against freezing temperatures for the duration of the curing period. Then after discontinuance of water curing, this concrete shall be maintained above freezing for the next 72 hours. Where artificial heat is employed, special care shall be taken to vent the heater and to keep concrete from drying.

____ REPAIR OF CONCRETE

a. General. - Concrete shall be repaired in accordance with this paragraph and USBR M-47

b. Submittals. - Submittals shall be in accordance with paragraph ____ (Submittal Requirements) and USBR M-47.

c. Method of repair or replacement. - The method of repair or replacement shall be as determined and directed by the Contracting Officer and in accordance with USBR M-47.

d. Cost. - The cost of furnishing all materials and performing all work required in the repair of concrete shall be borne by the Contractor.

[13][____ PAYMENT

Payment for all concrete, including the cost of furnishing and placing reinforcing bars [14][and fabric], will be made at the lump-sum price bid in the schedule for [15](concrete _____).

The lump-sum price bid in the schedule for [16][concrete _____] shall include the cost of supplying the cementitious materials quantities specified in paragraph ____ (Composition). If the Government requires the Contractor to use cement in excess of these amounts, such additional cement will be paid in accordance with the clause entitled "Changes."]

[17][____ COST

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[13] Include if pay item for concrete included in solicitation. Delete if concrete to be included in cost of other item(s) of work. Revise if pay item is for cubic yards.

[14] Delete if fabric not required.

[15] Revise as required.

[16] Revise as required.

[17] Include if cost of concrete to be included in other item(s) of work. Delete if pay item for concrete included in solicitation.

The cost of all labor and materials required for concrete under these specifications, including the cost of furnishing and placing reinforcing bars [18][and fabric], shall be included in the lump-sum price bid in the schedule for [19][_____].

The lump-sum price bid in the schedule for [20][_____] shall include the cost of supplying the cement quantities specified in paragraph ___(Composition). If the Government requires the Contractor to use cementitious materials in excess of these amounts, such additional cementitious materials will be paid in accordance with the clause entitled "Changes."]

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[18] Delete if fabric not required.

[19] Revise as required.

[20] Revise as required.